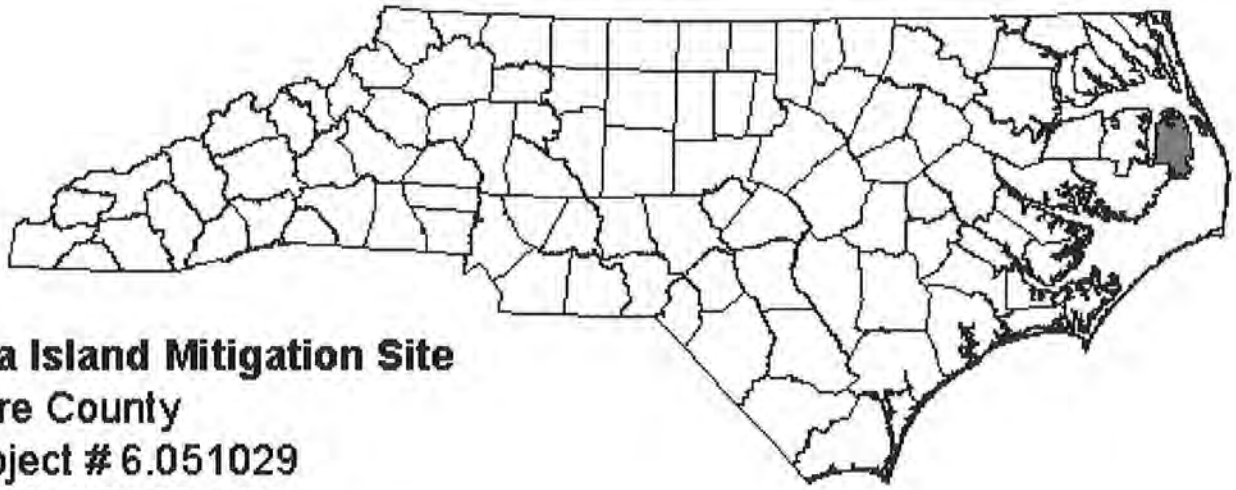
ANNUAL REPORT FOR 1998



Pea Island Mitigation Site
Dare County
Project # 6.051029
TIP # R-3113 WM

Prepared By:
Natural Systems Unit
Planning and Environmental Branch
North Carolina Department of Transportation

December 1998

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1.0 INTRODUCTION

1.1 Project Description

The Pea Island Mitigation Site is located in Dare County approximately 3.5 miles south of Pea Island Refuge maintenance facility, immediately west of NC 12 (Figure 1). The site consists of approximately 37.6 acres of wetland establishment and is designed as mitigation for the relocation of NC 12.

1.2 Purpose

In order to demonstrate successful mitigation, the site is monitored for both wetland hydrology and vegetation. The following report describes the results of the hydrologic and vegetative monitoring during the 1998 growing season at the Pea Island Mitigation Site. Also included is a consecutive day analysis of the 1997 hydrologic data. The analysis is provided as an addendum to the 1997 report, in which cumulative days were incorrectly tallied to demonstrate hydrologic success.

1.3 Project History

March 1996	Site planted
June 1996	Vegetation Monitoring (1 mo.)
October 1996	Vegetation Monitoring (1 yr.)
June 1997	Monitoring Wells Installed
June- November 1997	Hydrologic Monitoring
September 1997	Vegetation Monitoring (2 yr.)
March- November 1998	Hydrologic Monitoring
August 1998	Vegetation Monitoring (3 yr.)

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, a site meets hydrologic criteria if it is inundated or saturated (within 12" of the surface) by surface or ground water for at least 12.5% of the growing season. However, discussions between NCDOT and natural resource agencies have determined that, due to the unique character of this site, the normal guidelines for hydrologic success may not apply. Groundwater levels may vary significantly on a daily basis due to a sandy substrate that is in close proximity to a tidally-influenced body of water.

The growing season in Dare County begins March 13 and ends November 25. These dates correspond to a 50% probability that air temperatures will drop to 28° or lower after March 13 and before November 25.[1] Thus the growing season is 256 days; optimum wetland hydrology requires 12.5% of this growing season, or 32 days. The site must also experience average climatic conditions in order for the hydrologic data to be considered valid.

2.2 Hydrologic Description

Four monitoring wells, one rain gauge, and one surface water gauge were installed on site in June 1997 (Figure 2). The automatic monitoring wells and rain gauges record the depth to groundwater and rainfall, respectively. Data was collected on a daily basis throughout the growing season.

Appendix A contains a plot of the water depth for each monitoring well and surface water gauge in 1998. Precipitation events are included on each graph as bars.

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The largest number of consecutive days in which the groundwater was within twelve inches of the surface was determined for each well. The number of days was then converted into a percentage of the 256-day growing season. Table 1 gives the results for the 1997 growing season, while Table 2 shows the 1998 results.

[1] Soil Conservation Service. Soil Survey of Dare County, North Carolina, p.69.

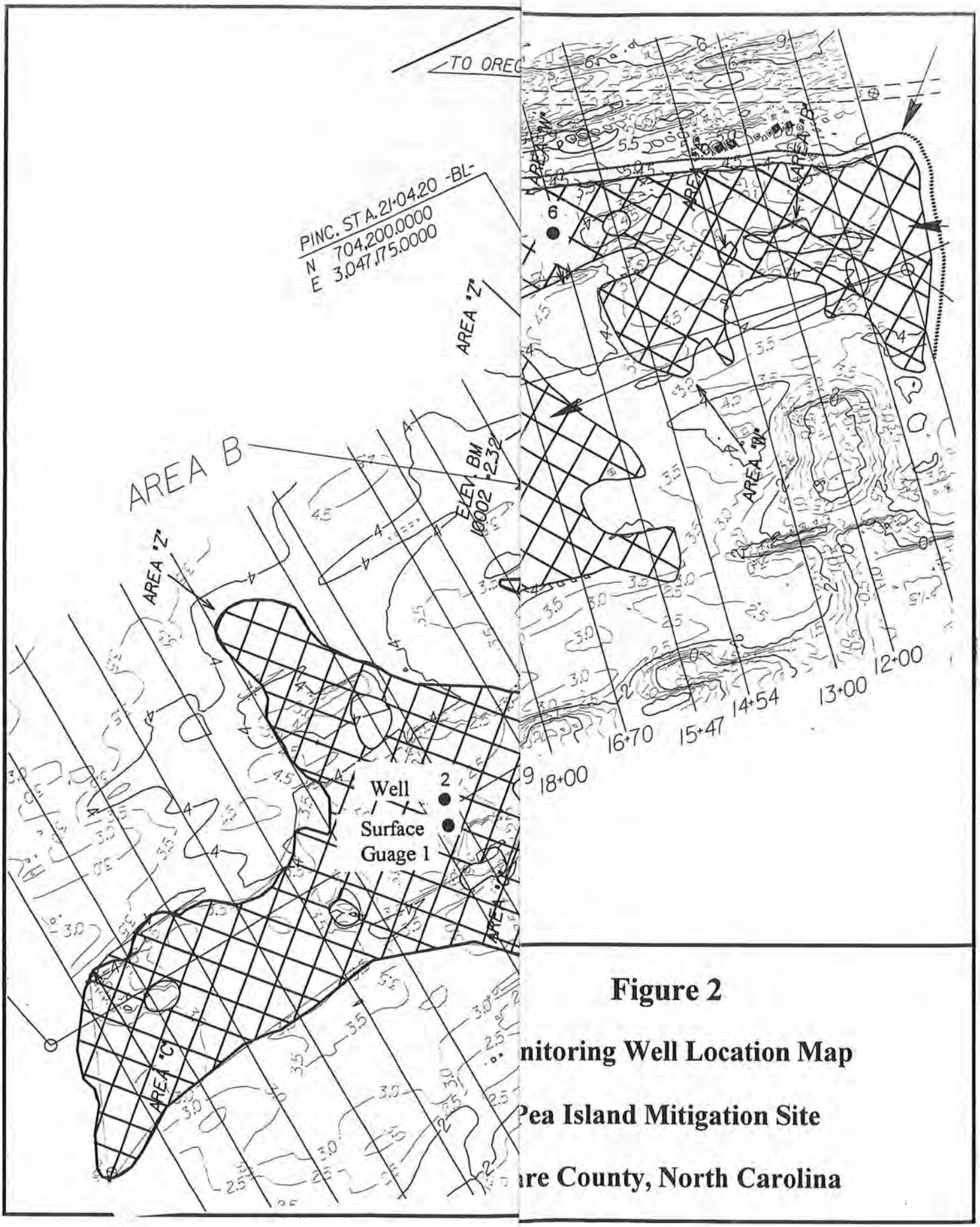


Figure 2

nitoring Well Location Map

Pea Island Mitigation Site

are County, North Carolina

TABLE 1
1997 HYDROLOGIC MONITORING RESULTS

Monitoring Well	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %
PI-2				✓	15.6
PI-3				✓	15.6
PI-5				✓	14.8
PI-6				✓	14.8

TABLE 2
1998 HYDROLOGIC MONITORING RESULTS

Monitoring Well	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %
PI-2				✓	82.4
PI-3				✓	39.8
PI-5				✓	14.1
PI-6				✓	14.1

Due to malfunctioning monitoring wells, the groundwater data for the 1998 growing season is incomplete. These wells will be replaced prior to the start of the 1999 season.

The surface water gauge registered surface water the entire 1998 growing season.

2.3.2 Site Data

Figure 3 is a comparison of 1998 monthly rainfall to historical precipitation for the area. The two lines represent the 30th and 70th percentiles of historical monthly precipitation for Manteo, NC. The bars are the monthly rainfall totals for 1997 and 1998. The historical data was gathered from the National Climatic Data Center; the recent rainfall totals were provided by the State Climate Office of North Carolina. Because of data availability, the 1998 rainfall encompasses precipitation through August. Also, the data for April and May of 1998 was not available. The 1999 annual monitoring report will include a 30-70 percentile graph with the monthly rainfall from the winter of 1998.

December was the month in 1997 with rainfall totals above the average. 1997 was a dryer year in Manteo. The first three months of 1998 were wetter than normal; however, rainfall in the summer of 1998 was average for the area.

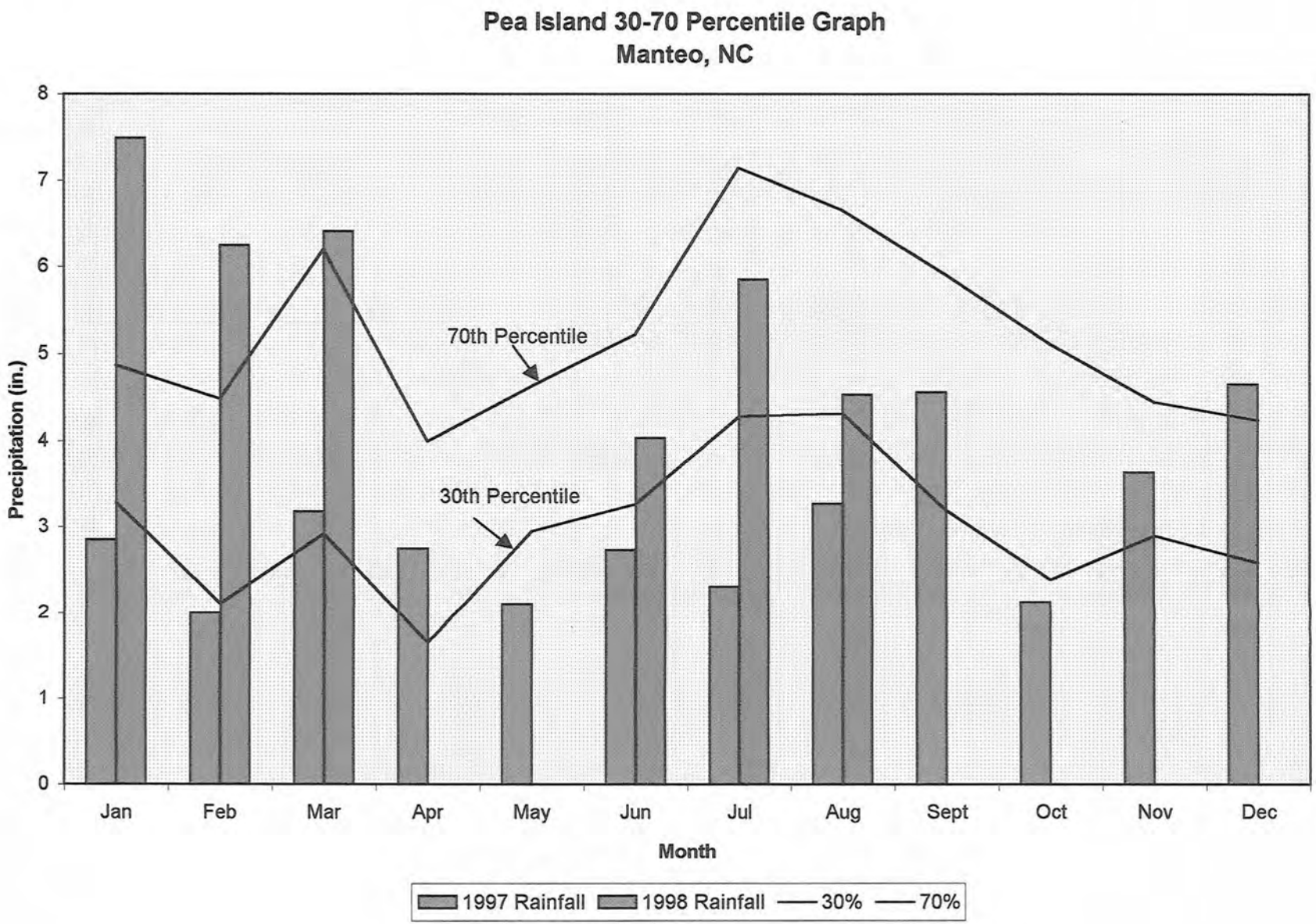


FIGURE 3
30-70 PERCENTILE GRAPH

2.4 Conclusions

Though the monitoring wells were not installed until June, 1997 yielded wetland hydrology at all four monitoring stations. The site continued to meet hydrology in 1998, during periods of average rainfall for the region.

3.0 VEGETATION

3.1 Success Criteria

Success Criteria states that there must be a 50% survival rate of plants for at least three consecutive years.

3.2 Description of Species

The following species were planted in the Wetland Restoration Area:

Panicum amarum
Panicum amarulum
Scirpus americanus
Scirpus robustus
Scirpus olneyi
Bidens aristosa

3.3 Results of Vegetation Monitoring (3 year)

TABLE 3 – VEGETATION MONITORING RESULTS - Area "A"

Plot #	Panicum amarum	Panicum amarulum	Scirpus americanus	Scirpus robustus	Bullrush	Echinochloa walteri	Other	% Coverage (3 year)
1	10%			80%	10%			100%
2	20%	5%	30%	30%			5%	90%
9				35%	20%	20%	5%	80%
	AVERAGE COVER (%)							90%

TABLE 4 – VEGETATION MONITORING RESULTS - Area "B"

Plot #	Panicum amarulum	Scirpus americanus	Scirpus robustus	Bullrush	Echinochloa walteri	Other	% Coverage (3 year)
3		20%	15%		30%	10%	75%
4		25%	25%		40%		90%
5		10%	25%		25%		60%
6		5%	50%		15%		70%
7		5%	30%		30%	5%	70%
8	5%	20%	60%			5%	90%
10		25%		20%		5%	50%
	AVERAGE COVER (%)						72%

3.4 Conclusions

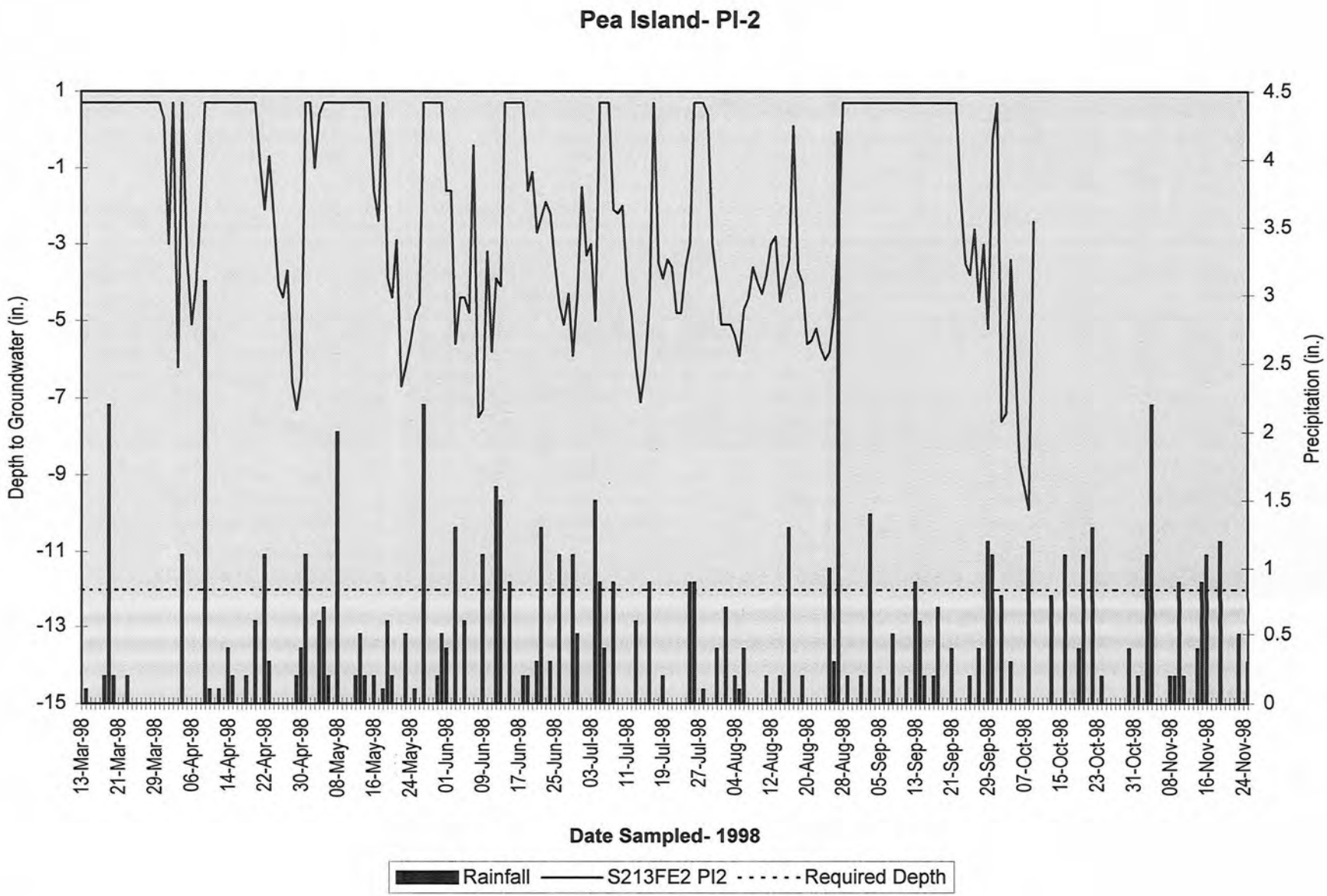
There is 36.7 acres of marsh established on this site. There were 10 monitoring plots established throughout the site, three within the area "A" and seven within area "B". The average aerial coverage of grasses in area "A" is 90%. The average aerial coverage of the grasses in area "B" is 72%. Based on the third year monitoring results, the average aerial coverage in both Area "A" and Area "B" exceeds the Success Criteria for this site.

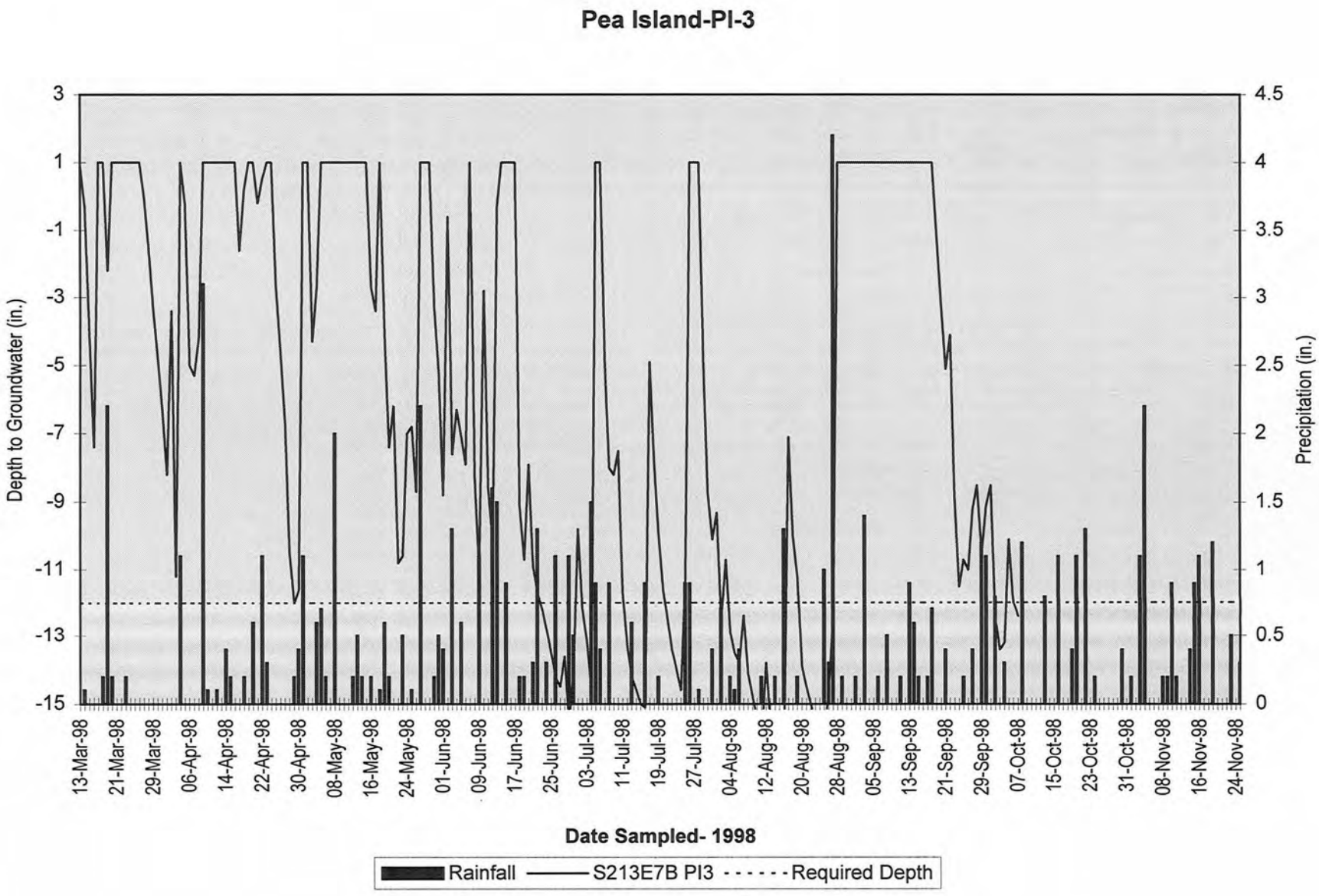
4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

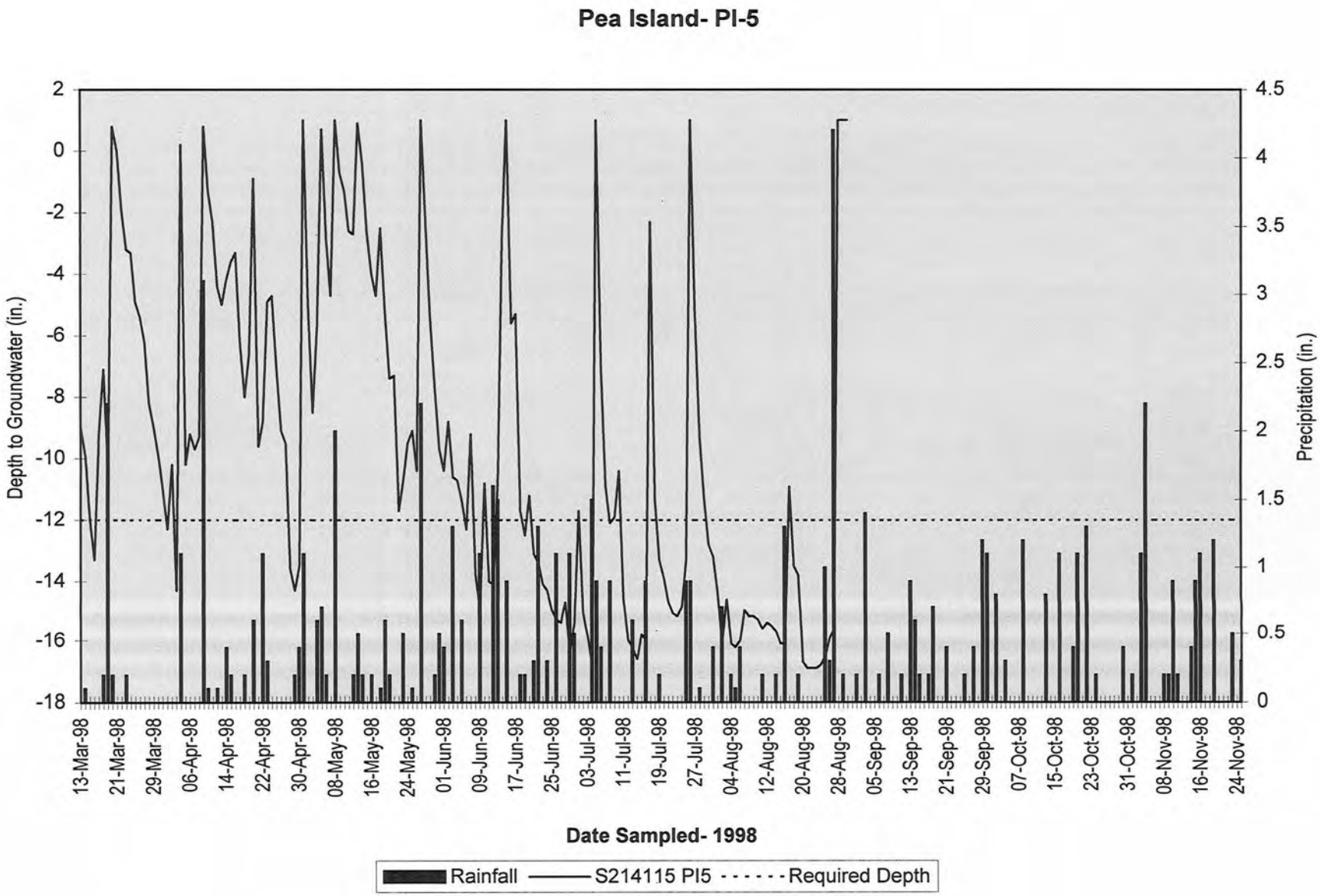
- Due to the third year success in vegetation, it is recommended that vegetation monitoring be discontinued.
- Hydrologic monitoring on the Pea Island Mitigation Site will continue.

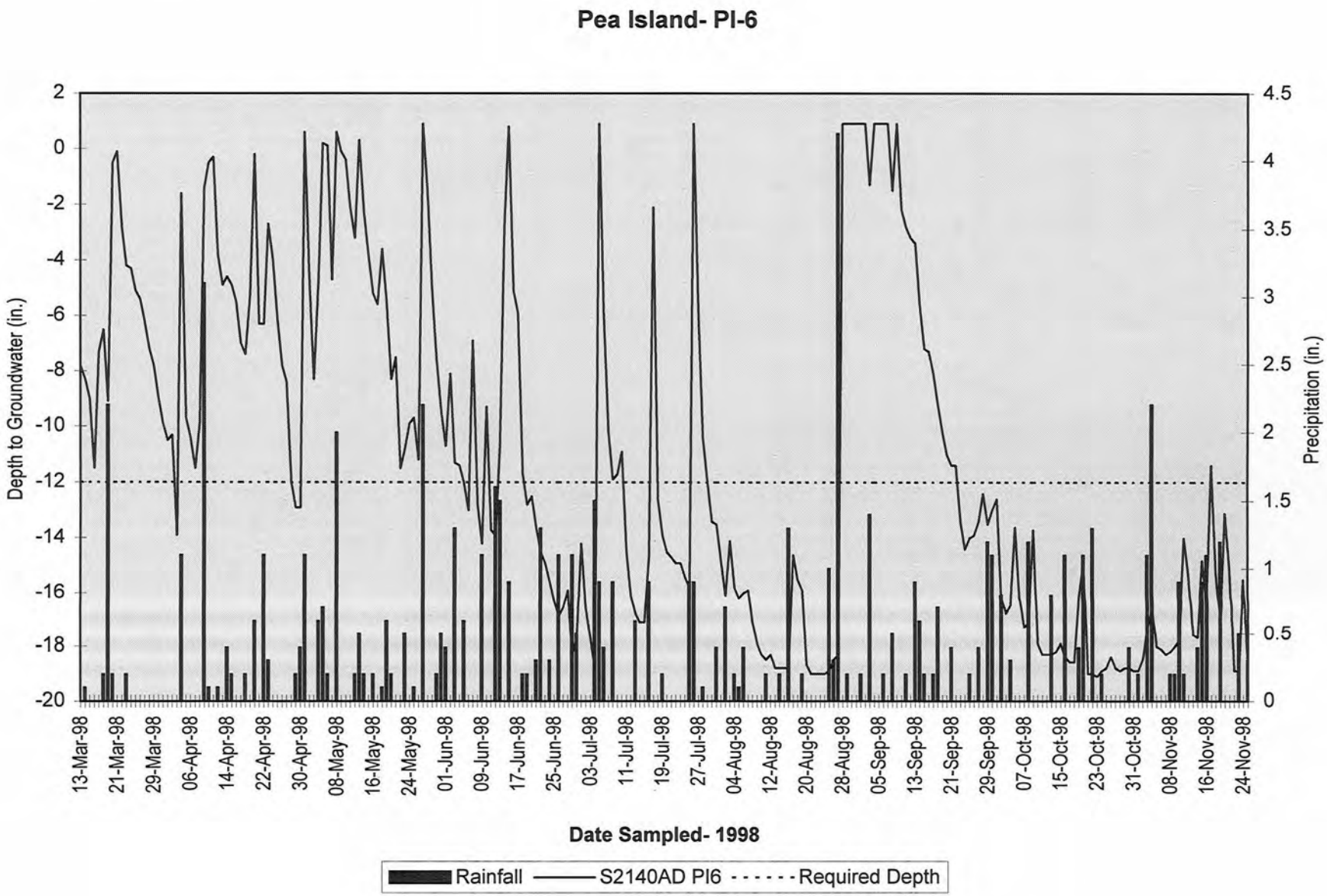
APPENDIX A

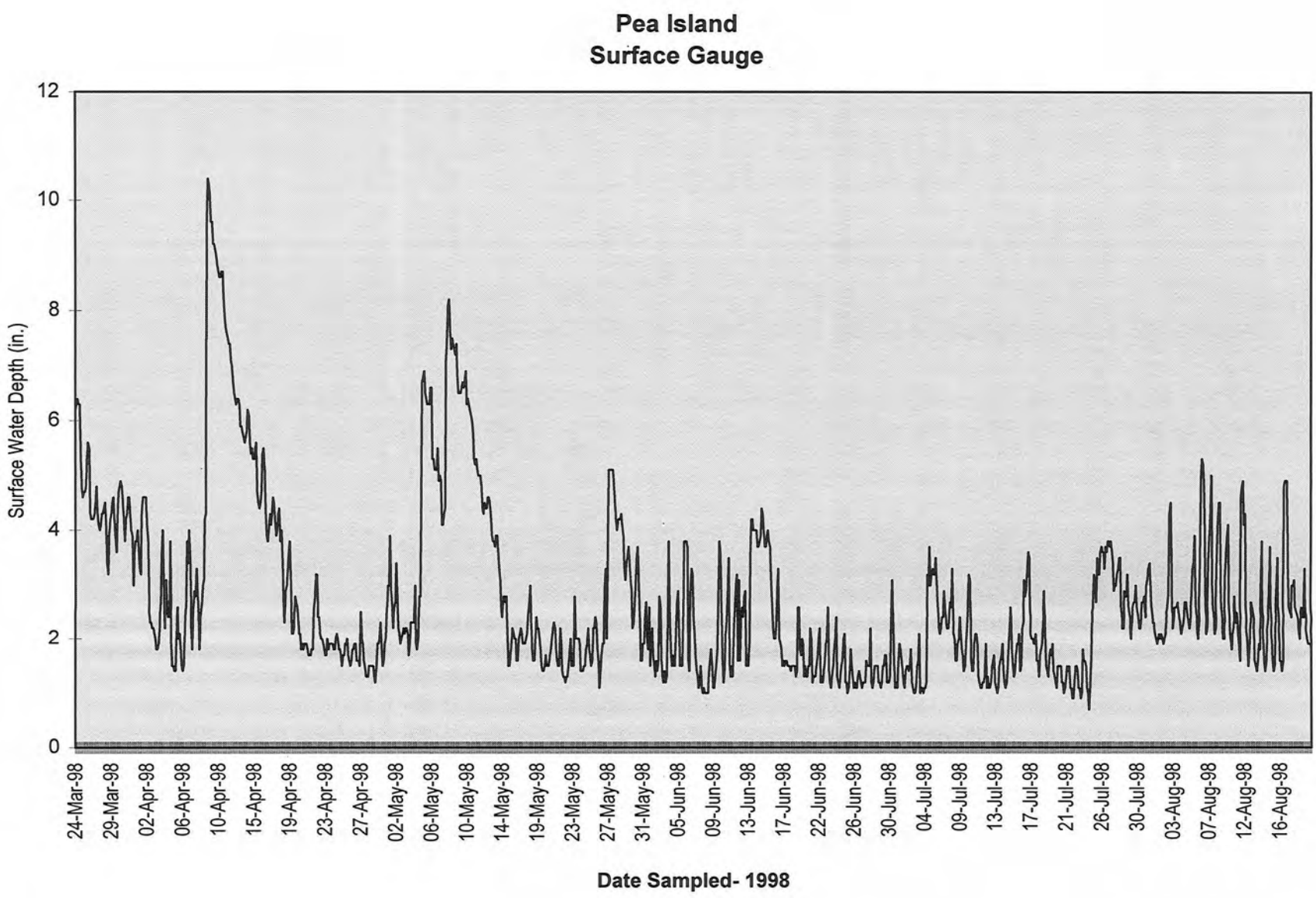
DEPTH TO GROUNDWATER PLOTS


Pea Island- PI-2
Depth to Groundwater (in.)
Precipitation (in.)
1
-1
-3
-5
-7
-9
-11
-13
-15
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
13-Mar-98
21-Mar-98
29-Mar-98
06-Apr-98
14-Apr-98
22-Apr-98
30-Apr-98
08-May-98
16-May-98
24-May-98
01-Jun-98
09-Jun-98
17-Jun-98
25-Jun-98
03-Jul-98
11-Jul-98
19-Jul-98
27-Jul-98
04-Aug-98
12-Aug-98
20-Aug-98
28-Aug-98
05-Sep-98
13-Sep-98
21-Sep-98
29-Sep-98
07-Oct-98
15-Oct-98
23-Oct-98
31-Oct-98
08-Nov-98
16-Nov-98
24-Nov-98
Date Sampled- 1998
Rainfall
S213FE2 PI2
Required Depth


Pea Island-PI-3
Depth to Groundwater (in.)
Precipitation (in.)
3
1
-1
-3
-5
-7
-9
-11
-13
-15
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
13-Mar-98
21-Mar-98
29-Mar-98
06-Apr-98
14-Apr-98
22-Apr-98
30-Apr-98
08-May-98
16-May-98
24-May-98
01-Jun-98
09-Jun-98
17-Jun-98
25-Jun-98
03-Jul-98
11-Jul-98
19-Jul-98
27-Jul-98
04-Aug-98
12-Aug-98
20-Aug-98
28-Aug-98
05-Sep-98
13-Sep-98
21-Sep-98
29-Sep-98
07-Oct-98
15-Oct-98
23-Oct-98
31-Oct-98
08-Nov-98
16-Nov-98
24-Nov-98
Date Sampled- 1998
Rainfall
S213E7B PI3
Required Depth


Pea Island- PI-5
Depth to Groundwater (in.)
Precipitation (in.)
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
13-Mar-98
21-Mar-98
29-Mar-98
06-Apr-98
14-Apr-98
22-Apr-98
30-Apr-98
08-May-98
16-May-98
24-May-98
01-Jun-98
09-Jun-98
17-Jun-98
25-Jun-98
03-Jul-98
11-Jul-98
19-Jul-98
27-Jul-98
04-Aug-98
12-Aug-98
20-Aug-98
28-Aug-98
05-Sep-98
13-Sep-98
21-Sep-98
29-Sep-98
07-Oct-98
15-Oct-98
23-Oct-98
31-Oct-98
08-Nov-98
16-Nov-98
24-Nov-98
Date Sampled- 1998
Rainfall
S214115 PI5
Required Depth


Pea Island- PI-6
Depth to Groundwater (in.)
Precipitation (in.)
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
13-Mar-98
21-Mar-98
29-Mar-98
06-Apr-98
14-Apr-98
22-Apr-98
30-Apr-98
08-May-98
16-May-98
24-May-98
01-Jun-98
09-Jun-98
17-Jun-98
25-Jun-98
03-Jul-98
11-Jul-98
19-Jul-98
27-Jul-98
04-Aug-98
12-Aug-98
20-Aug-98
28-Aug-98
05-Sep-98
13-Sep-98
21-Sep-98
29-Sep-98
07-Oct-98
15-Oct-98
23-Oct-98
31-Oct-98
08-Nov-98
16-Nov-98
24-Nov-98
Date Sampled- 1998
Rainfall
S2140AD PI6
Required Depth


Pea Island
Surface Gauge
Surface Water Depth (in.)
0
2
4
6
8
10
12
24-Mar-98
29-Mar-98
02-Apr-98
06-Apr-98
10-Apr-98
15-Apr-98
19-Apr-98
23-Apr-98
27-Apr-98
02-May-98
06-May-98
10-May-98
14-May-98
19-May-98
23-May-98
27-May-98
31-May-98
05-Jun-98
09-Jun-98
13-Jun-98
17-Jun-98
22-Jun-98
26-Jun-98
30-Jun-98
04-Jul-98
09-Jul-98
13-Jul-98
17-Jul-98
21-Jul-98
26-Jul-98
30-Jul-98
03-Aug-98
07-Aug-98
12-Aug-98
16-Aug-98
Date Sampled- 1998

APPENDIX B

SITE PHOTOS

Pea Island

BOUNDARY

APPENDIX C

MONITORING PARTNERING MEETING MINUTES

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT JR.
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201

E. NORRIS TOLSON
SECRETARY

December 4, 1998

Dr. G. Wayne Wright, Chief
Regulatory Branch
U.S. Army Corps of Engineers
Post Office Box 1890
Wilmington, North Carolina 28402

Dear Wayne:

Re: NCDOT/Resource Agency Partnering Meeting - Monitoring Guidelines

A meeting was held on July 22, 1998 in the NCDOT Photogrammetry Conference Room in Raleigh to discuss monitoring guidelines for the 1998 Annual Monitoring Reports. Please find attached a list of those in attendance and the meeting agenda. Following introductions, Charles Bruton described the purpose of the meeting and opened the floor to David Franklin for any opening comments. David said he looked forward to resolving any previous discrepancies in the 1997 Annual Monitoring Reports and discussing ways to better present monitoring results in this year's monitoring reports. Phil Harris moderated the meeting.

HYDROLOGIC MONITORING

NCDOT and the Corps agreed wetland mitigation sites must meet the guideline for hydrology (1987 Manual) using *consecutive* days and not cumulative days of the locally designated growing season. Wetland hydrology criteria in the 1987 Manual notes that a site must be seasonally inundated or saturated (within 12 inches of the surface) greater than 12.5 percent of the local growing season. NCDOT will re-evaluate the 1997 monitoring data to reflect consecutive days rather than cumulative days of the growing season.

Regarding monitoring well data, David wants to see compliance is met and that the sites are working. Phil noted that NCDOT is taking a close look at recurring problems associated with monitoring well installation and maintenance. In cases where hydrology was failing for a particular site, NCDOT would be unable to remediate the site until the following year due to seasonal constraints and the necessity to collect specific hydrographic information. In discussing what was considered to be hydrologic success,

David Franklin said the 1987 Manual was the official guideline. However, he went on to suggest that the Corps would be interested to see a more detailed breakdown of the well data and would not be opposed to hydrologic success based on a longer monitoring period with less than a 12.5 % success criteria. He also mentioned well data that falls below the 12 inch threshold may also be examined as a special case. Mike Bell suggested site remediation should occur now rather than waiting until December. NCDOT, in coordination with the Corps, will identify unsuccessful sites and work together to determine how the site is failing and the best remediation techniques to implement.

VEGETATION MONITORING ISSUES

Due to NCDOT's demand for hardwood seedlings there is a shortage of seedlings this year and there was none available for remediation efforts. There is a minimum one year lead time for ordering seedlings. In a situation on a site where the well data is good but the vegetation is not successful the Corps stated they would review it on a site by site basis. In cases of remediation, Charles said it was almost impossible to grade and plant a site before the winter deadline.

Randy Wise requested an extension of the August/September time period to obtain the vegetation monitoring data for the sites. After discussing this issue, it was agreed that the marsh sites would be evaluated in August and the hardwood sites could be evaluated as late as October and November before leaf drop. The NCDOT will send a "blanket" letter to the Corps to modify all permits to reflect the revised vegetation monitoring period. Phil mentioned that although there would be an extension of the monitoring period for vegetation, monitoring reports would continue to be completed and distributed by the end of December. Randy said they often perform random site visits throughout the year to see how vegetation is performing and would perform supplemental planting if noted early enough in the growing season.

Ken Jolly asked who was responsible for downloading wells and did they look at vegetation. Beth Smyre said the Geotechnical Unit downloaded well data and notified her of any vegetation issues. The Corps requested that proposed remediation for hydrology and vegetation be included in monitoring reports. NCDOT and the Corps will coordinate any remediation measures. Randy expressed their commitment to remediate vegetation as soon as possible.

The discussion turned toward planted versus volunteer species. The Corps does not want to see volunteer species included in survival rate calculations for planted species. Randy noted the survival rate is set at 50% or higher. David wanted to make sure that the sites meet the target species requirement in stems per acre, not a percentage (except for older sites set up for percentage). David also wanted to see the distribution of species planted and volunteer. Randy said it is often difficult to identify certain species during the first two years (several oak species often look alike as saplings). Generally it is easier to differentiate the species by the third year. The Corps wanted to know if there was a way to identify the planted species at planting. However, the planting procedure is

so labor intensive now it would make it impossible to do so. The 50 foot by 50 foot monitoring plots are chosen and staked in the field after planting has occurred. The Corps wants NCDOT to note the unwanted volunteer species and to identify possible remediation to make sure these species do not dominate the site. The NCDOT and the Corps agreed that the distribution of species is such that no species dominates more than 20 % of the distribution. Red maple and sweet gum are generally not to be planted to insure good numbers of target species.

HYDROLOGIC SUCCESS CRITERIA

The incorporation of reference systems in determining success was discussed. David concluded that if a particular site failed under the 1987 Manual guidelines, then NCDOT had the option of comparing site parameters to reference site parameters in determining success. The purpose of reference systems was to allow NCDOT a second option in achieving success. The determination of a reference system with its success criteria would need to be addressed in the mitigation plan. The use of the hydrogeomorphic system (HGM) was also discussed. The Corps is not going to use HGM as a reference system, but will probably look at it as a tool. There are no guidelines out yet on HGM.

The use of 20-80 versus 30-70 probability graphs, as defined by WETS. was discussed. These graphs compare the specific year rain data to the historical data for the mitigation site area. The NRCS and WETS use the 30-70 probability graphs and NCDOT would like to use these as well. It was decided to use the 30-70 information and to go to the nearest gage station as long as the source was cited. David determined that if a site's hydrology performs at 12.5%, then hydrologic success has been achieved. If a site performs in the 5% to 12.5% range, then there is "marginal" hydrologic success. If this trend continues, then the entire success criteria for the site will be reviewed.

The target percentage for hydrological success should be included in the permit and shown in the mitigation plan. The Corps will be willing to negotiate on the success of the site, but include adequate information in the permit and the mitigation plan.

Charles Bruton suggested placing monitoring wells in the impacted wetland areas to assess and compare to mitigation areas. David wanted to insure that the best mitigation site attainable is created. David also asked that well performance be broken out in the report.

An interim report was given on Mud Creek. It was noted that wells placed in the reference wetland and wells placed in the created wetland were an inappropriate method to determine hydrologic success because the difference in soil type, hydrology, and cover type.

Mike Bell discussed results of a workshop he attended on monitoring wells. He also discussed the use of piezometers.

There was no further discussion and the meeting adjourned. Please advise if you have any questions regarding the meeting, minutes, or agenda.

Sincerely,

V. Charles Bruton

V. Charles Bruton, Ph.D.
Assistant Branch Manager
Planning and Environmental Branch

VCB/el

Attachments

July 22, 1998—9:30 @ Century Center in Photographic Conference Room

NCDOT/Resource Agency Partnering Meeting to Discuss Monitoring Issues

AGENDA

Introductions

Purpose & Goals of Meeting
- Standardize the monitoring reports

Hydrologic Monitoring
- Consecutive vs. Cumulative days
- Data interpretation

Vegetation Monitoring Issues
- Planted vs. Voluntary plants
- Monitoring timeframe

Success Criteria
- Geographical considerations
- Reference systems

Monitoring Report Presentation
- Text
- Figures to be included
- Tables
- Photographs
- Submittal dates

7/22/98

NCDOT/RESOURCE AGENCY PARTNERING MEETING

NAME	AGENCY	PHONE NO.
Phil Harris	NCDOT - P&E	(919) 733-7844 (x-301)
Ed Lewis	NCDOT - P&E	" (240)
Hal Bain	P&E	(919) 733-7844 x 309
Scott McLendon	Corps of Engineers	910-251-4725
David Franklin	"	910 251-4952
Mike Bell	"	919-825-1616 x26
DAVE [illegible]	"	910-25[illegible]-4634
David Cox	NCWRC	(919) 528-9886
Eric [illegible]	Corps - Raleigh	[illegible] 876-8441 x[illegible]
Ken [illegible]	" "	(919) 876-8441, x22
Beth Smyrl	NCDOT - P&E	(919) 733-7844, x 33[illegible]
Kenara Williamson	NCDOT - P&E	x335
LeiLani Paugh	NCDOT P&E	" x 332
Tanner Holland	NCDOT P&E	" x 280
[illegible]	[illegible]	
Randy K. Wise	NCDOT - REU	(919) 733-2920
Charles Tomlinson	NCDOT-REU	733-2920
RANDY GRIFFIN	NCDOT - REU	733-2920
Charles Bruton	NCDOT - P&E	733-7844 x 308